

*With the Author's Compliments*  
**HUTCHISON (J. C.)**  
PRIZE ESSAY.

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# ACUPRESSURE.

AN ESSAY

TO WHICH WAS AWARDED THE  
MERIT H. CASH PRIZE, BY THE MEDICAL SOCIETY OF  
THE STATE OF NEW YORK, FEBRUARY, 1869.

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By JOSEPH C. HUTCHISON, M. D.,

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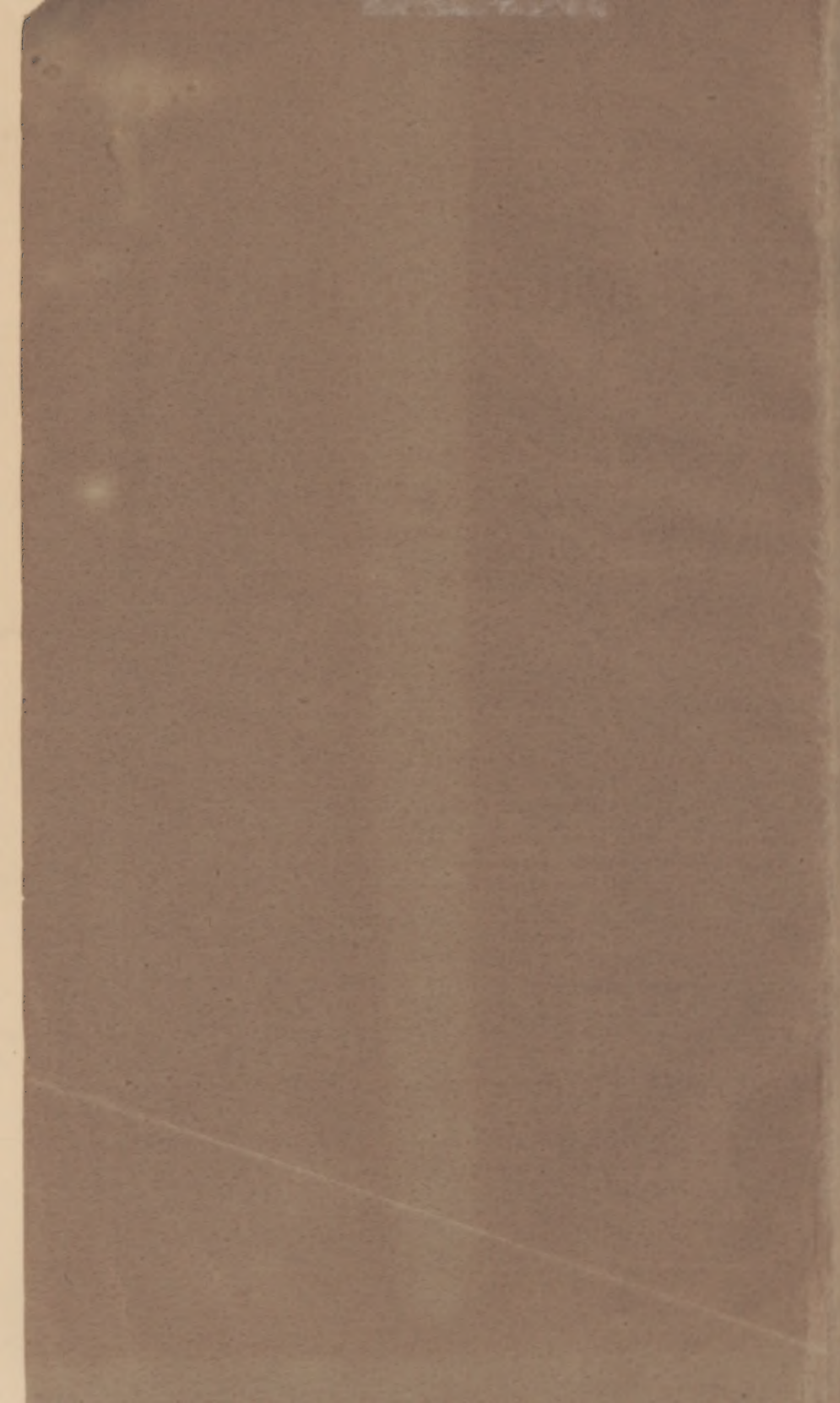
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*"Rem acu tetigi."*

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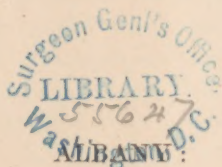
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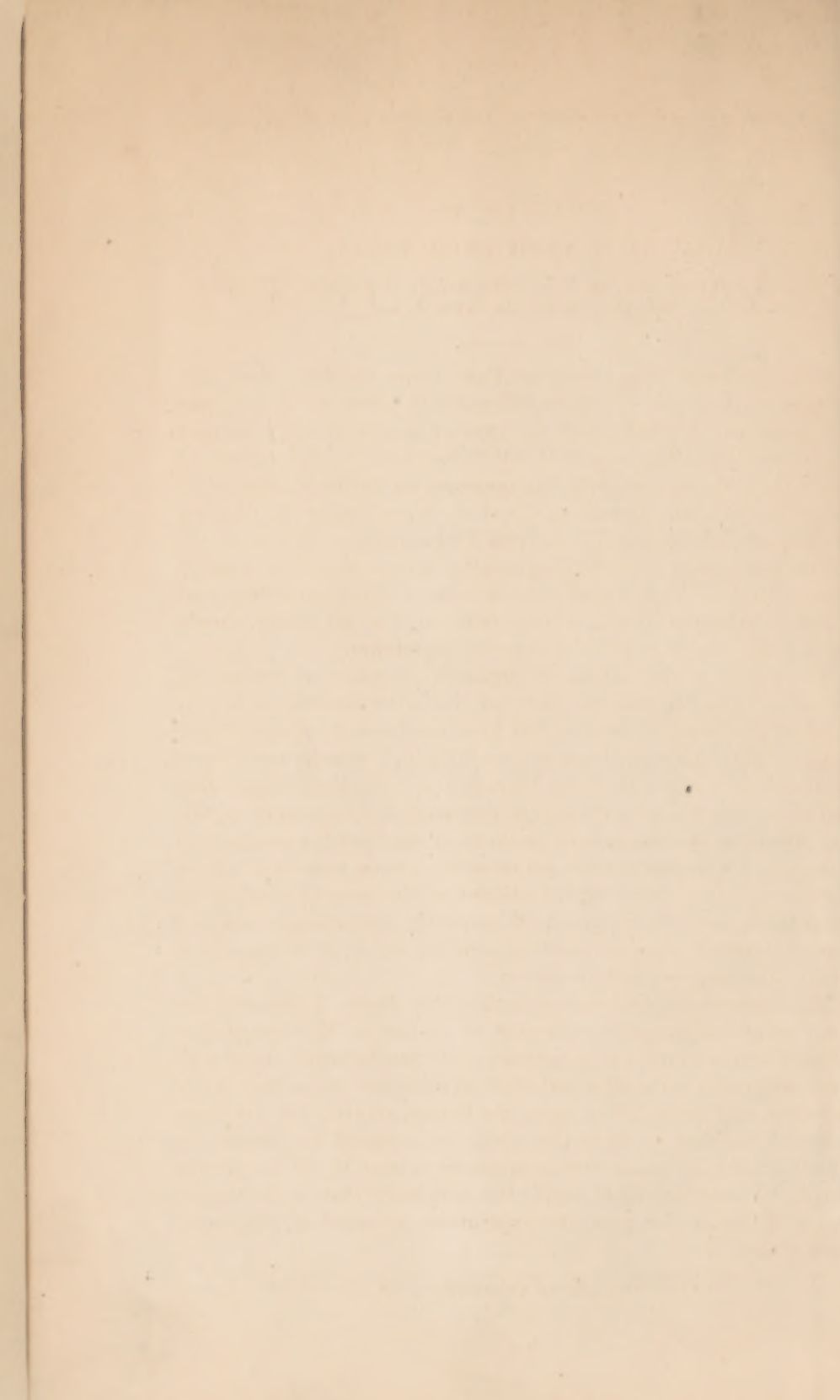
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## ARTICLE IV.

### MERIT II. CASH PRIZE ESSAY.

A PRACTICAL TREATISE ON ACUPRESSURE, BY JOSEPH C. HUTCHISON,  
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*"Rem acu tetigi."*

Since the time when Ambrose Paré, three hundred years ago, proposed that surgeons "should bid eternally adieu to all hot-irons and cauteries," and substitute the ligature as a hemostatic, nothing comparable to it was suggested until December 9, 1859, when Sir James Y. Simpson described "Acupressure, an Excellent Method of Arresting Surgical Hemorrhage, and of Accelerating the Healing of Wounds," to the Royal Society of Edinburgh.

The best means of controlling arterial hemorrhage is a topic of such interest to the practical surgeon, that, it is not surprising that a new hemostatic process, which claims to excel all others, should stand forth as a subject of the foremost importance.

The object of this article is, primarily, to place on record the results of some experiments made on the lower animals, as well as observations on the arteries of the human subject, in order to determine (1) the pathological mechanism by which arteries are obliterated when their mouths have been closed by acupressure-needles, and (2) to test the reliability of acupressure as a hemostatic agent, and (3) to describe the various methods of applying the needle, and (4) to give a synopsis of the cases in which I have practiced it upon man, and (5) to express my appreciation of the procedure and of its advantages over other methods of arresting hemorrhage, with the hope of exerting some influence in securing for it an unprejudiced trial by the surgeons of this country.

The masterly and exhaustive work of Sir James Y. Simpson on Acupressure (Edin. 1864), like that of Jenner on Vaccination, has left but little for others to investigate. He has, however, stated that "no sufficiently extensive series of experiments upon the lower animals, or of observations upon the human subject, has yet been collected together, to show the whole pathological mechanism by which arteries are closed when acupressure is used."\* It was for the purpose of contributing to supply this deficiency, that, at the suggestion of Professor Simpson, the experiments recorded in this paper were made.

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\* Simpson on Acupressure, p. 536.

*Instruments required for Acupressure, and the Methods of applying them.*

The various modes of Acupressure have been so fully explained in the excellent treatise of Drs. Pirrie and Keith, that I should deem it unnecessary to consider the subject here, if that work were more generally distributed in this country.

The instruments required for the practice of Acupressure are, bayonet-pointed pins, varying in length from three to five inches, with glass heads to facilitate their introduction, needles threaded with iron wire, and loops of slender annealed iron wire, five or six inches in length. The pins and needles should be bayonet-pointed, because they can be more easily introduced than the round needle, and do not cut the tissues like the spear-pointed needle. But, on the cut surface of a flap, I have found the ordinary sewing needle to answer perfectly. Fig. 1.\*

The principal methods of Acupressure now in use, are as follows, viz. :

*The First Method*, which requires the use of the pin alone, is performed by pressing the left forefinger or thumb upon the mouth of the bleeding vessel, pushing the pin from the cutaneous surface through the whole thickness of the flap, and causing its point to emerge to the right side of, and close to the vessel. The head of the pin is then depressed so that the projecting end is carried across the artery, when it is made to re-enter the cut surface of the flap close to the left side of the vessel, and pressed on until the point emerges through the skin. The head and point of the pin are exposed externally, and the (fig. 2) middle portion bridges over and compresses the artery against the flap, to use the expression of Professor Simpson, "just in the same way as, in fastening a flower in the lapelle of our coat, we cross over and compress the stalk of it, with the pin which fixes it, and with this view push the pin twice through the lapelle." Fig. 3.

Only a small portion of the pin is exposed upon the cut surface, and this may often be avoided by passing it higher up in the flap. Fig. 3.

*The Second Method* consists in inserting a needle threaded with twisted iron wire (to facilitate its removal) into the soft tissues a little to one side of the vessel, making it emerge close to the artery; it is then carried across its track, and dropped down again, and thrust into the soft tissues on the other side of the vessel. Fig. 4.

In bridging over the arterial tube, the end of the needle must be

\* These appliances may be obtained from Mrs. Geo. Tieman & Co., 67 Chatham St., New York.



well pressed down upon the vessel so as to close it, before the needle is fixed in the tissues beyond. Occasionally a pin may be conveniently used, instead of a needle. This method is not often used, but it answers very well for acupressing vessels of moderate size.

*The Third Method* consists in passing a needle threaded with iron wire, twisted (as seen in fig. 4), behind the bleeding vessel in the wound, throwing a loop of the wire over the point of the needle, compressing the artery between the wire-loop in front and the needle behind, and finally fixing the wire by a half twist around the eye end of the needle. The appearance of the vessel is shown in fig. 5. The needle is removed by pulling the twisted wire, when, the loop being liberated, it is easily withdrawn. Fig. 5.

*The Fourth Method* is the same as the third, substituting the pin for the needle. The pin can be more easily applied and withdrawn, and therefore should be preferred in all cases where the head can be kept without the wound, without straining the tissues. The wire with which the needle is threaded is apt to kink, and cause pain when removed. When the pin is used, this kinking is avoided. The mechanism of the third and fourth methods will be made more intelligible by reference to Fig. 6.

Nothing can be more efficient than the third and fourth methods of acupressure but whenever it is practicable some other should be employed, for the reason that even with great care, we are in danger of lacerating the coats of the vessel, or injuring the tissues by drawing the wire tighter than is necessary merely to occlude the artery.

*The Fifth Method* is performed with either pin or threaded needle. There are two varieties, in one of which (known as "the Aberdeen twist") the instrument is caused to rotate over a quarter of a circle, and in the other, it makes a rotation of a half circle. In the former, or Aberdeen method, the instrument is inserted on one side of the bleeding vessel, pushed onward a few lines parallel with the direction of the artery, and its point caused to emerge on the surface of the wound, as shown in Fig. 7, A.

The pin or needle is then made to undergo a quarter-rotation so as to place it across the artery, it is then pressed down against the vessel so as to close its tube, before the point is fixed, by being passed into the tissues beyond. (Fig. 7, B.) This method is an admirable one, and I can fully indorse all that is claimed for it, by the distinguished Aberdeen surgeons, Messrs. Drs. Pirrie and Keith.\*

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\* See their Treatise on Acupressure.

In the second variety of the fifth method, first proposed by Sir J. Y. Simpson,\* the pin or needle is introduced precisely as in the third and fourth modes.

It is then twisted as in the first variety, but to the extent of half a rotation, around the artery, so as to bring its point to the opposite side of the vessel, where its head was before making the twist. (Fig. 8, B.) The point of the instrument is then well pressed down and secured in the proper position by being thrust into the tissues beyond. This variety is also eminently satisfactory. A few days since I closed the brachial artery by this method, in the most expeditious and efficient manner.

*The Sixth Method* is accomplished with a pin and a loop of wire. The pin is inserted into the tissues on one side of the artery and close to its mouth, and is carried transversely to the vessel through the tissues to the opposite side. An end of the wire is held in each hand; the loop thrown over the point of the pin; and the ends brought back on each side of the artery are crossed behind the body of the pin, and drawn in opposite directions sufficiently tight to close the vessel. The ends are then brought up on each side of the pin, and the wire is fixed by a half twist around its head.

The end of the wire held in the left hand should be crossed in front of that in the right, in order to facilitate its removal. If there is any difficulty in removing the wire, it may be obviated by twisting the front wire from right to left. The arrangement of wire and needle is shown in the diagram. Fig. 10.

I have frequently used a modification of this mode when there were several bleeding points close together, by passing a needle through the center of the bleeding mass, and surrounding it with a wire, as in the above method.

*The Seventh Method* is essentially the same as the second, except that the pin enters the flap from the cutaneous surface. The middle portion of the pin in front of the integument bridges over the (Fig. 11) artery and compresses it against the bone. The pin appears as is shown in Fig. 11.

The following plan, which, for convenience, may be called the *Eighth, or Brooklyn Method* of Acupressure, is an excellent plan for the closure of arteries in their *continuity*. It was devised by the writer, and practiced in all the experiments on the lower animals described in this paper.

The artery is first exposed by the usual incision; a loop of wire about eight inches long is laid in the wound, parallel with and on the

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\* See his work on Acupressure p. 64.



side of the vessel next the head of the pin; the pin is now carried through the flesh from its integumentary surface, half an inch, more or less (according to the depth of the vessel), back from the edge of the incision, so as to bring it down to the plane of the artery, and then over the wire, and beneath the vessel, without disturbing the vital and organic relations with nerve, vein, or its sheath (Fig. 12, A); when the pin has emerged from beneath the artery, the wire-noose is thrown over the point (Fig. 12, B); the point is then pushed through the opposite flap, at a point corresponding to that at which it entered (fig. 12, C); the wire-loop is next brought over the track of the vessel, which is now compressed between the pin *below* and the wire *above*, and lastly, the wire is secured by a half-turn around the pin, as is shown in Fig. 12, C; the wound is then closed by metallic sutures; the removal of the pin, at the end of the twenty-four or forty-eight hours, liberates the loop, which can then be easily withdrawn.\*

The artery, vein and nerve are left, by this procedure, in their normal positions, with their vital connections undisturbed, and there is nothing between the lips of the wound to prevent primary adhesion. We avoid, in this way, the prolonged irritation of the ligature, and the danger of local ulceration, sloughing and secondary hemorrhage, which so often occur after deligation of the arteries, for the cure of aneurism, etc.

*Observations showing the Pathological Mechanism by which Arteries are obliterated when closed by Acupressure.*

*Experiment 1.*

The left common carotid artery of a sheep was exposed by dissection, and closed by a pin in the manner described on page 6. (Fig. 12.)

The vessel was then divided on the distal side of the pin, when free hemorrhage occurred, as was expected, from its distal extremity. This was arrested by another pin applied in the same manner, and the wound accurately closed by metallic sutures, there being nothing between the lips of the wound to interfere with union by first intention. The vital relations of the parts were left undisturbed by this procedure. It may be well to state, in order to avoid undue repetition, that in all the experiments herein detailed, this same method of acupressure was employed; and the writer believes that it will prove to be a useful expedient for closing arteries in their continuity, for the treatment of aneurism and the like. At the end of forty-one

\* The same thing may be accomplished by carrying a single thread of wire under the head end of the pin after it has passed behind the vessel; the two ends are then carried across the track of the vessel and secured by a half-turn around the point end of the pin before it is pushed through the opposite flap.

hours, both needles were removed, with the loss of only two or three drops of blood, which arose from the disturbance of the healing surface by the removal of the wire which had been passed around one of the needles.

*Dissection.* The animal was killed twenty-five days after the operation. The artery, vein and nerve were matted together by inflammatory deposits. Two inches of the artery, on both sides of the point of division, were removed, and placed under water. An effort was made to force air through the vessel, by means of a blow pipe, but both ends were found to be perfectly closed, at the seat of the acupressure. On opening the vessel no clot was found in either distal or cardiac ends, but they were firmly closed, by means of a dense fibro-cellular tissue, for the extent of one-third of an inch, as is shown by the specimen. (Fig. 13.)

A careful microscopic examination of the specimen was made by Dr. R. Cresson Stiles. He found that "the artery at the place of operation had been cemented to surrounding tissues by organized exudation, so that the continuity of the vessel was demonstrated only by dissection. Lymph had been effused both within and without the vessel, at the point of acupressure, and the extremities were connected together by firm fibrous tissue," which may be seen in the specimen. (Fig. 13.)

#### *Experiment 2.*

This observation was made in the same sheep, after an interval of thirteen days. The right common carotid artery was exposed by dissection, and closed by two needles, placed half an inch apart. The vessel was divided between them without hemorrhage. The needles were removed at the end of forty-one hours, without the loss of a drop of blood, and the animal suffered no apparent inconvenience from the occlusion of both arteries. The sheep was killed twelve days after this operation. Two inches of the vessel on either side of the point of acupressure were removed. After placing the specimen under water, an attempt to force air through the artery, by means of a blow-pipe, was made, but its calibre was firmly closed. On opening the vessel, a purplish clot, half an inch in length, was found on the distal sides, which was separable from the internal coat of the vessel except at its base. The base of the clot was decolorized and firmly adherent to the inner surface of the vessel. The same condition obtained on the cardiac side, the clot there being three-eighths of an inch long. The artery, at the point of operation, had been converted into a dense fibro-cellular cord, for the distance of one-eighth of an inch, its coats were three or four times their usual thickness, and its calibre correspondingly diminished. (Fig. 14.)



*Experiment 3.*

The left common carotid artery of a very large and strong sheep was exposed by dissection, and its calibre closed by an acupressure-pin applied in its continuity. The pin was removed at the end of fifty hours, and the animal killed ten days after the operation. The artery was adherent to the surrounding tissues, and its canal was firmly occluded, as shown by trial with the blow-pipe, as before. The internal and middle coats of the artery, at the point of acupressure, were found to have been divided in their entire circumference, and the external coat, in one-half its circumference, indicating that the pressure had been more forcible than necessary. Firm, red, conical clots, three-fourths of an inch, and one inch, in length, respectively, occupied the vessel on either side of the seat of the operation; they were but slightly attached except at their bases, where they were closely adherent to the inner coat of the artery. The mouths of the vessel were perfectly closed by organized lymph. Its coats were thickened at and about the point of pressure, but to a less degree than in the previous experiments. (Fig. 15.)

The object of this experiment was to observe the condition of the vessel after acupressure in its continuity, but failed in consequence of the too great pressure applied in closing it, whereby the coats of the artery had been divided.

*Experiment 4.*

The right common carotid of the same sheep, on which the last experiment was performed, was closed by two acupressure pins, three-fourths of an inch apart, and the artery divided between them. An assistant was directed to remove them in thirty-six hours, but it was forgotten, and they were not removed until the end of seventy-four hours. The animal was killed four days after the application of the pins, and the artery with the vein and nerve was removed. By means of the blow-pipe, the vessel being immersed in water, I ascertained that both extremities were perfectly closed. Its mouths were closed, not firmly, by what appeared to be primary adhesion, and the union was strengthened by adhesion of the outer coat to the sheath and the adjacent tissues. The cardiac end was distended to nearly twice its natural size by a moderately firm, red, conical clot, two inches long, attached closely at its base, but slightly beyond that point. The distal end was of normal size, and was occupied by a tolerably firm, red, conical clot, one and a half inches long, and one-half the diameter of the clot on the cardiac side. In both the distal and cardiac ends the vessel was thinned for the distance of one-fourth of an inch from their cut extremities; this, I believe, was owing to the prolonged pressure of the pins (74 hours). (Fig. 16.)



*Experiment 5.*

The left common carotid artery of a dog was closed, by an acupuncture pin, in its continuity. At the end of twenty-five hours the pin was removed, and the animal was killed on the seventh day. The artery was agglutinated to the surrounding tissues by organized exudation, and when it was placed under water, air could not be forced through it with the blow pipe. On the cardiac side of the point of acupuncture, the vessel was filled with a clot one inch long; on the distal side the clot was one third of an inch in length. The clot was continuous, and, at the point where the pin had been applied, it was firmly adherent to the vessel. A careful examination of the specimen shows that the anterior half of the external coat is cut through at the point of pressure. This may have been caused by undue pressure of the wire, but, probably, it was owing to the small amount of yellow elastic tissue found in the arterial coats of the dog. The diameter of the vessel was diminished at the seat of operation, by the thickening of the internal and middle coats. (Fig. 17.)

*Experiment 6.*

The left common carotid of a sheep was closed, in its continuity, by acupuncture. The needle was removed at the end of forty-seven hours, and the vessel at the same time was vivisectioned, together with two inches of the par vagum nerve. The animal, so far as could be observed, did not suffer the slightest inconvenience from the operation. The vessel, tried by the blow pipe, was found to be perfectly closed. It was occupied by a firm, red clot, three fourths of an inch long, conical at its extremities, its center being, at the point of operation, which was indicated by an indentation made by the needle, on its posterior surface. The cardiac and distal clots were continuous, as in the last experiment. The clot was intimately connected with the internal coat of the artery, at the seat of acupuncture, and the vessel is slightly contracted at this point. (Fig. 18.)

An interesting point, connected with the two specimens last described, is, that the distal and cardiac clots were shown to be continuous by dividing the vessels longitudinally. The needle was applied with sufficient firmness, I am sure, not only to arrest the pulsation in the vessels, but also to place their walls in close contact. I can only explain the continuity of the clots, by supposing that some thinning of the walls was produced by the pressure of the needle, and that, by this thinning, the hold of the instrument was sufficiently relaxed to allow the vessel to expand somewhat, and the two clots to approximate and unite.

*Experiment 7.*

The right common carotid artery of a dog was closed in its continuity by acupressure. The pin was removed in twenty-nine hours. Twenty-four days after the operation, the dog was killed and the artery removed. One-third of an inch of the vessel, at the place of operation, was converted into a solid fibrous cord, in which no trace of the arterial coats could be found by Dr. R. Cresson Stiles, who made a careful microscopic examination of the specimen. On both the distal and cardiac sides of the solid portion were found the remains of a red clot. (Fig. 19.)

This specimen shows, in the most satisfactory manner, the ultimate changes which take place in an artery after successful acupressure. A ligature could not have obliterated the canal more thoroughly.

This completes the account of the experiments upon the arteries of the inferior animals, and the following description of two specimens taken from the human subject, together with the histories of the cases, will finish this branch of the subject.

*Case 1.—Amputation at the Knee-joint—Acupressure by the First, Third, Fourth and Fifth Methods—Death on the seventh day.*

Anna M—, aged 40 years, was brought to the Brooklyn city Hospital, December 8th, 1867, suffering from a severe lacerated wound, on the outer part of the left foot and ankle, exposing the ankle-joint, caused by the wheel of a city railroad car. Being a woman of good constitution and habits, it was thought advisable to make an effort to save the limb. The wound was dressed by a saturated solution of carbolic acid, in water. Five hours after admission, free hemorrhage took place from a branch of the anterior tibial artery, which was promptly arrested by House Surgeon X. C. Scott, who placed two needles under the vessel, one above and the other below the bleeding point, securing the artery by the third method of acupressure. The needles were removed at the end of thirteen hours, without a return of the bleeding. On the fourth day, erysipelas attacked the foot, and extended nearly to the knee, followed by free suppuration in the cellular tissue. On December 23d her condition was such, that a consultation of the surgeons of the hospital was called; it was decided to remove the leg at the knee-joint. The inflammation in the parts had caused all the smaller arteries to enlarge, so that eleven required acupressure. Ten needles were used, one needle securing two arteries. The popliteal was promptly and easily closed by the fifth method (quarter rotation); the other vessels were secured, two by the first, five by the third, one by the fourth, and two by the sixth methods. The flaps were accurately

approximated by iron wire sutures. No dressings were applied. Seven needles were removed at the end of twenty-two hours, two in forty-seven, and the one applied to the popliteal, at the end of forty-eight hours, notwithstanding the pulsations communicated from it to the needle had not entirely ceased. The writer's previous experience with acupressure, as applied to the arteries of the sleep, convinced him that the vessel was sufficiently occluded, and that the needle might safely be removed. No bleeding followed the withdrawal of any of the needles. The patient bore the anæsthetic (ether) badly; she vomited frequently during the operation, and vomiting persisted until a few hours before her death, which took place, from exhaustion, seven days and nineteen hours after the operation.

The post mortem examination was confined to the examination of the stump. A mass of lymph surrounded the extremity of the popliteal artery, agglutinating it with the vein and nerve. A portion of the vessel, three inches in length, was separated from the enveloping mass, and when placed under water, it was found to be impervious. The extremity of the vessel was contracted, and its mouth closed with lymph. Its canal was filled by a conical red clot, half an inch long, extending upward to the first anastomosing branch. The coagulum adhered closely to the vessel near its mouth. (Fig. 20.) The stump was in a sloughy condition; there had been no effort, whatever, at repair.

*Case 2. — Amputation of the leg — Acupressure by the Third and Fourth Methods — Consecutive hæmorrhage from vessels which had not been acupressed — Death from exhaustion.*

James Brady, aged 22 years, entered the Brooklyn City Hospital, January 2, 1868, with a compound, comminuted fracture of the left leg, at the junction of the middle and lower thirds. There had been considerable hæmorrhage from the wound, for which a tourniquet was applied to the femoral, and pressure made over the wound, by the direction of Dr. Codrane, surgeon in charge. This failed to arrest the bleeding, and on the following morning an effort was made to secure the bleeding artery, when it was found that the injury to the bones and soft parts was of so grave a nature that amputation would be necessary. The operation was made by Dr. Codrane in the most skillful manner, below the tuberosity of the tibia, and with his consent I closed the arteries by acupressure. The anterior tibial and a muscular branch were closed by the third method, the posterior tibial, with its vein, which bled freely, was closed with one needle by the fourth method. The wound was closed accurately by iron wire sutures, and no dressings were applied. The patient vomited



frequently from the effects of the ether, and four hours after the operation I was summoned to see him, on account of free hemorrhage from the stump. Dr. Cochran having placed the case under my charge, I at once opened the wound, the patient being again anesthetized, and found that the bleeding proceeded from the end of the tibia, and from two muscular branches, one in the upper, and one in the lower flap, which did not bleed at the time of the operation. These vessels were closed by acupressure, by the third and fourth methods, and the bleeding from the bone was arrested by Squibb's solution of the subsulphate of iron. The vessels which had been acupressed at the time of the operation were found, on careful examination, to be perfectly closed. The wound was again brought together with iron-wire sutures.

The consecutive hemorrhage was, undoubtedly, due to the violent vomiting, which continued after the operation, and forced out the coagula which had stopped the smaller vessels. The vomiting persisting, the patient was unable to retain nourishment or stimulants, and he died from exhaustion forty-nine and a half hours after the amputation. The needles were removed from the muscular branches at the end of thirty hours, and from the anterior and posterior tibial arteries in forty-eight hours, without the loss of a drop of blood.

The stump was examined, post-mortem, by House Surgeon Scott, who, unfortunately, preserved only the posterior tibial artery, on account of the hurried manner in which the examination was necessarily made. There was no union of the flaps and no clots in the stump. The cut extremity of the posterior tibial was inclosed in a mass of lymph, with the vein and nerve. The artery was found impervious by trial with the blow-pipe, the specimen having been placed under water. A clot, half an inch long, occupied the cavity, and, at its base, was firmly adherent to the inner coat of the vessel. (Fig. 21.) The condensation and decolorization of the clot were less advanced than in the specimen last described.

*Relative pathological mechanism, by which arteries become closed spontaneously, by the use of Ligatures, and by the action of Acupressure needles.*

The results of the above experiments conclusively show that Acupressure is a perfectly reliable means of arresting surgical hemorrhage. No fact in surgery is more thoroughly established than that the vessels in a stump can be as promptly and firmly secured by Acupressure needles as by a silk ligature, and without inflicting injury upon the living tissues.

The experiments also show that, when the mouths and tubes of arteries are closed by acupressure, the pathological mechanism which leads to their temporary as well as their permanent occlusion, is similar to that which follows the arrest of hemorrhage spontaneously, and by the employment of the ligature. That is to say, in each process there is a temporary barrier — the internal blood clot — until coagulable lymph is effused, as a result of adhesive inflammation, making a permanent barrier, aided by the gradual constriction of the calibre of the artery, and its ultimate conversion into a fibro-cellular cord.

Let us examine more particularly the mechanism by which arteries become closed *spontaneously*; by the use of the *ligature*, and by the action of the *acupressure needle*.

The following quotation is from the masterly work of Jones on "The process employed by Nature for the Suppression of Arterial Hemorrhage" (page 54.) "A coagulum then formed, at the mouth of the artery, and within its sheath, and which I have distinguished in the experiments by the name of the *external coagulum*, presents the first barrier to the effusion of blood. The coagulum, viewed externally, appears like a continuation of the artery, but, on cutting open the artery, its termination can be distinctly seen with the coagulum completely shutting its mouth, and inclosed in its sheath.

"The mouth of the artery being no longer pervious, nor a collateral branch very near it, the blood just within it is at rest, coagulates and forms, in general, a slender conical coagulum, which neither fills up the canal of the artery, nor adheres to its sides, except by a small portion of the circumference of its base, which lies near the extremity of the vessel. This coagulum is distinct from the former, and I have called it the *internal coagulum*.

"In the meantime, the cut extremity of the artery inflames, the *vasa vasorum* pour out lymph, which is prevented from escaping by the external coagulum. This lymph fills up the extremity of the artery, is situated between the external and internal coagula of blood, is somewhat intermingled with them, or adheres to them, and is firmly united all around to the internal coat of the artery.

"The permanent suppression of the hemorrhage chiefly depends on this coagulum of lymph, but, while it is forming within, the extremity of the artery is further secured by a gradual contraction which it undergoes, and by an effusion of lymph between its tubes, and into the cellular membrane surrounding it, in consequence of which these parts become thickened, and so completely incorporated with each other, that it is impossible to distinguish the one from the other; thus, not only is the canal of the artery obliterated, but its

extremity also is completely effaced, and blended with the surrounding parts. \* \* \* From this view of the subject, we can no longer consider the suppression of hemorrhage as a simple or mere mechanical effect, but as a process performed by the concurrent and successive operations of many causes. These may be briefly stated to consist in the retraction and contraction of the artery, the formation of a coagulum at its mouth, the inflammation and solidification of its extremity by an effusion of coagulating lymph within its canal, between its tunics, and in the cellular substance surrounding it."

The pathological changes which occur in an artery when it has been secured by a *ligature*—as deligation is now generally practiced—are as follows:

Mr. Jones, by a series of admirably conducted experiments, has shown that the *immediate effects* of a ligature upon an artery are a complete division of its internal and middle coats, and the strangulation of its outer one. The ligature does the office of the *external coagulum*; *i. e.*, it acts as a temporary barrier until the *internal coagulum* is formed, and while plasma is being effused from the lacerated tunics, between the coats of the vessel and into its sheath, uniting them firmly together, and also causing adhesion of the clot to the internal coat of the artery, thus effecting its permanent occlusion. The coagulum next becomes vascular, and, finally, with the walls of the artery, is converted into a solid fibrous cord, which commonly extends, as the clot did from the seat of the ligature to the first principal branch above. That portion of the artery immediately embraced by the ligature, and just beyond it, mortifies, and the ligature is detached when the slough is thrown off. In the words of Sir James Simpson—whose opinions, in this department of surgical pathology, are entitled to the highest consideration—"before the separation of a ligature can be effected, it requires to cut through a strangulated tube by a process of ulceration or molecular disintegration and gangrene; and there are set up, as a necessary consequence, in the immediate vicinity of the ligatured and strangulated artery, the process of local disjunctive ulceration and suppuration."

The experiments which have been detailed by the writer, show that the pathological mechanism, by which arteries are obliterated when they have been closed by *acupressure-needles*, does not differ in the outset, and in its ultimate results from that which is observed when hemorrhage is arrested spontaneously, or by the application of a ligature. The needle, like the ligature, does the office of the external coagulum, which forms when bleeding ceases spontaneously. The blood, between the needle and the first branch above, becomes stagnant, and an internal coagulum is allowed to form.



Dr. R. Cresson Stiles, who examined, microscopically, specimens one, five, six and nine, expresses the opinion that "the clot certainly does not organize, the swollen walls of the vessel grasp it tightly, send their blood vessels into it, absorb it, and replace the clot by their own hypertrophy and exudation; the clot serving as an irritant or stimulus to keep up the abnormal vascularity until it disappears."

Adhesive inflammation is also excited by the presence of the needle pressing the walls of the vessel together, and by the irritation resulting from the division of the artery, causing adhesion of the walls of the vessel to each other, and of the outer coat to the sheath or other immediately adjacent tissues. Finally the vessel is converted into a fibro-cellular cord (Fig. 19), presenting the same appearances as those which follow the use of the ligature.

But there is a vast difference in the amount of inflammation which results from the two procedures. By the use of the acupuncture-needles placed across the mouths and tubes of arteries, their internal surfaces are merely placed in close contact; and the pressure necessary to arrest arterial hemorrhage by the needle is not sufficient to produce strangulation. The exudation of lymph goes on from the vasa vasorum into the mouth and sheath of the vessel, and it is permanently closed by adhesive inflammation. The needles can be withdrawn with safety from the wound, at the will of the surgeon, at periods varying from 13 to 48 hours. This, the experience of the writer has shown.

But when an artery is closed by a ligature, the internal coats are lacerated, and the external is strangulated, leading to its destruction by ulceration, suppuration and death at the constricted point; dead, putrefying sloughs (the ends of the vessels), are left applied to the absorbing surface of the recent wound, the ligature, left in the wound for an indefinite period, absorbs the secretions, which speedily decompose and act as a foci of irritation to the surrounding tissues; all of which conditions prevent union by primary adhesion, and expose the patient to the danger of septic poisoning.

### *Torsion as a substitute for the Ligature.*

The torsion of arteries for the arrest of hemorrhage is an old procedure, mentioned by Galen, and reintroduced by Thierry, Amusat and Volpeau; at one time strongly condemned, at another highly lauded, it has lately been revived by the great Mr. Syme, of Edinburgh, as a substitute for the ligature, and is now practiced to a considerable extent abroad. It is a well established fact that when torsion is applied to a large artery, the effect of the twisting and laceration of its coats is to destroy and to deprive them of vitality.

followed by suppuration as marked as that which is caused by the application of the ligature. "By the tearing," says Chelius, "and bruising of the arterial coats in torsion, separate fragments of the coats die off and suppurate."\*

"The advantage that torsion is supposed to possess over the ligature," remarks Mr. Ericksen, "is more fancied than real; the twisted end acts as a foreign body, and is as likely to interfere with union as the pressure of the ligature."† Professor Miller of Edinburgh, speaking of the effects of torsion, says that "the twisted portion of the vessel *must* slough and separate; the noose of a ligature is not more truly, or to a greater extent a foreign body."

*Importance of practicing Acupressure upon the Cadaver, and upon the lower animals.*

My first experiment with Acupressure was performed upon the dead subject. It was made by amputating the thigh, and afterward introducing the nozzle of a Davidson's syringe into the common iliac artery. A strong man then pumped water into the artery with sufficient force to throw a stream through the severed ends of the femoral to the distance of five feet. No difficulty was found in arresting the flow by acupressure needles applied in the various methods which have been proposed. In order to acquire a facility of manipulating, I would strongly urge the necessity of thus practicing the operation. Indeed, a mere description of the process, even with the assistance of good illustrations, is difficult to comprehend. But it becomes at once perfectly simple, when tried experimentally, with the aid of diagrams, or still better when we can witness its application by one who is expert in the use of the needle. For the purpose of learning, from its distinguished author, the most successful modes of applying Acupressure, I visited Edinburgh, in the autumn of 1867, and I desire publicly to express my obligations to Sir James Y. Simpson, and his accomplished assistants, Drs. Black and Aitken, for their valued aid, and to the former for his generous hospitality.

*Synopsis of my Experience with Acupressure.*

I have now employed Acupressure on forty-four arteries in man, varying in size from muscular branches to the popliteal, and seven in the lower animals; and my assistants Drs. Elbrigg, Knox and Scott have each practiced it upon one artery, making a total of fifty-four arteries on which I have observed its effects. The needles were removed at periods varying from thirteen to forty-eight hours. In

\* See Chelius' "System of Surgery," Vol. 1, p. 310.

† See Erichsen's "System of Surgery," p. 153.

every case the occlusion of the vessel was thorough and complete. Among the operations in which it was employed were three amputations of the leg, one at the knee-joint, two of the fore-arm, one of the arm, one of the foot, one excision of the testis, and one wound of the radial artery.

A synopsis of the cases is given in the following table:

*Tabular View of Dr. Hutchison's Cases of Acupressure.*

No.	Sex.	Age.	Disease or Injury.	Operation.	Method of Acupressure.	Acupressure discontinued.	Result.
1	F.	12	Foot crushed by R. R. car; amputation of leg; end of bones exposed by sloughing of flaps.	Re-amputation of leg.	First, Third and Fourth.	After 47 hours.	Recovery.
2	M.	28	Bad stump from sloughing of flaps, after disarticulation of first four metatarsal bones.	Disarticulation of tarsus anterior to scaphoid bone.	First, Fifth and Sixth.	22 hours.	Recovery.
3	F.	49	Laceration of leg by R. R. car; ankle opened; erysipelas and suppurative cellulitis.	Disarticulation of knee-joint on 14th day.	First, Third, Fourth, Fifth.	22, 47 and 48 hours.	Death. (See Case 1 p. 11.)
4	M.	27	Compound comminuted fracture of leg.	Primary amputation of leg.	Third and Fourth.	30 and 48 hours.	Death. (See Case p. 12.)
5	M.	35	Wound of radial artery.	Ac'sureeds. rad. art.	Third.	25 hours.	Recovery.
6	M.	35	Hemorrhage from superficialis volæ; aching wound.	Acupressure of both ends of superficialis volæ.	Third.	27 hours.	Recovery.
7	M.	14	Compound comminuted fracture of fore-arm.	Primary amputation of fore-arm.	Fourth and Fifth.	22 hours.	Recovery.
8	M.	26	Fracture of condyles of humerus, rupture of brachial artery; gangrene.	Amputation of arm on 5th day.	Fourth and Fifth.	19 and 48 hours.	Recovery.
9	M.	38	Hand crushed.....	Prim. amp. fore-arm.	First, twice repeated, Third.	25 hours.	Recovery.
10	F.	40	Laceration of leg	Acu're musc. br. art.	Third.	13 hours.	Recovery.
11	M.	36	Compound comminuted fracture of foot.	Pluget's amputation of foot (primary).	Fifth.	22 hours.	Recovery.
12	M.	30	Serofibrous caries of bones of leg.	Amputation of leg...	Fifth, Sixth.	63 hours.	Recovery.
13	M.	36	—	Excision of testis	First.	19 hours.	Recovery.

*The time for the removal of the needles.*

The answer to the question "at what time should the needles be withdrawn?" is furnished, so far as my experience goes, in the above table. The popliteal, the largest artery which I have yet acupressed, was found closed in forty-eight hours (Case 1), while the needle was removed from the radial, ulnar and tibial arteries in twenty-two hours, and from smaller vessels in thirteen hours. I deemed it best, while accumulating practical knowledge on this subject, to err on the side of safety to the patient; but I now believe that in minor amputations and in wounds the needles may be withdrawn much earlier than I have hitherto done. No one, it is presumed, would advocate so early a discontinuance of the pressure as was practiced in one of Dr. Keith's cases of amputation of the thigh. The patient,



a boy twelve years old, amusing himself with the pin-heads protruding at the angles of the wound," withdrew the pin compressing the femoral artery *four hours* after it had been applied, and yet no hemorrhage resulted.\* In a case of excision of the mamma by Dr. Coghill, of Shanghai, the needles were removed in *two hours*, without there following any hemorrhage.†

The acupressure should be continued longer than usual, when the operation is followed by vomiting, as the straining might cause the expulsion of the forming coagula, and dangerous hemorrhage set in. Again, when pulsation is seen at the head of the pin, or when pulsation of the principal arteries can be felt up to the edge of the wound, we should be cautious in withdrawing the needles.

*Cases illustrating the simplicity and value of Acupressure.*

*Case 3.—Secondary hemorrhage from wound of the Radial and Superficialis Volæ Arteries — Needles applied to their distal and cardiac ends — Third Method.*

James Mankey, 33 years of age, entered the Brooklyn City Hospital, December 1, 1867, with an extensive laceration of the left forearm and hand. Four days subsequently sloughing took place, followed by hemorrhage from the radial artery. It was estimated that a pint of blood was lost in a very few minutes. The house surgeon stopped the bleeding, by applying a tourniquet to the arm, and Squibb's solution of the subsulphate of iron to the wound. When I reached the hospital, I applied two sewing-needles under the artery, one above and the other below the bleeding point, and surrounded each by the iron-wire noose (third method), with the effect of instantly checking the hemorrhage. The needles were removed at the end of twenty-two hours, with no return of the bleeding.

On the following day, bleeding occurred from the superficialis volæ, and a considerable quantity of blood was lost before the house surgeon, Dr. Elbrigg, could reach the bedside. He arrested the bleeding by the same method which I had employed the day before. At the end of twenty-seven hours the needles were taken away, bleeding did not return. These two examples illustrate in a striking manner, the usefulness of acupressure in cases of sloughing wounds. If ligatures had been used upon arteries in this sloughing mass, where their coats had been weakened by the inflammatory process, premature separation would have probably ensued, and

\* See Pirrie and Kieth on Acupressure, p. 174.

† See Simpson on Acupressure, p. 81.

bleeding recurred. If ligatures had been applied to the vessels, in sound tissues, above and below the bleeding points, a long, tedious and unsatisfactory dissection would have been necessary; all of which was avoided by the simple and rapid process of acupressure.

*Case 4.—Amputation of the Forearm.—Acupressure by the First Method—Three Arteries secured with one pin.*

James W. Anderson, aged 28, entered the Brooklyn City Hospital, October 19, 1868, with a compound, comminuted fracture of the metacarpal bones of the left hand, the soft parts being lacerated up to the wrist joint, caused by the falling of a trip-hammer. The forearm was amputated by Dr. Cochrane through its lower third, and, with his permission, I closed the radial, ulnar and interosseous arteries by one long pin. The pin was thrust through the skin and was carried under the radial and out again through the skin; it was then made to re-enter the skin on the radial side of the interosseous and ulnar arteries, to pass under those vessels and then out through the skin again. The three vessels were thus effectually compressed. The pin was removed at the end of twenty-five hours without the loss of a drop of blood. The patient was discharged at the expiration of one month.

*Case 5.*

The late Dr. Ems found it necessary to perform alar rhinotomy on a patient aged 30 years. Very free hemorrhage took place from the whole cut surface. It was impossible to seize the vessels and apply ligatures, he, therefore, applied the actual cautery, but, without success. Acupressure was then used with the effect of promptly controlling it.

*Appreciation of Acupressure.*

Having in the preceding pages explained the principal methods of applying Acupressure; illustrated by experiments on the lower animals and observations on the arteries of man, the pathology of the subject; and given a synopsis of the cases in which I have practiced the operation, it only remains to express the opinion of its value, to which I have been led by an impartial investigation of the subject.

It has been demonstrated by an experience of its application to arteries that surgical hemorrhage can be arrested by means of Acupressure. The extensive experience of Messrs. Fluvie and Koitz, who have compressed upward of eight hundred vessels, in two of whose cases only did secondary hemorrhage occur on the discontinuance of the pressure;\* together with the experience of Mr. Forster,† Dr. A.

\* See British Med. Journal, No. 348.

† See Guy's Hospital Reports, 1867.

Hewson and others,\* afford conclusive evidence of its efficiency. Indeed, the pathological changes which we have seen to take place in arteries that have been closed by acupressure would of themselves lead to the conclusion that it is a perfectly reliable procedure. So strong has become my conviction that, for the past twelve months, I have not taken ligatures into the operating room, and for two months during a recent service in the Brooklyn City Hospital, which accommodates from one hundred and fifty to two hundred patients, there was not a ligature in the institution.

Considering that the entire reliability of this procedure, for the arrest of surgical hemorrhage, has been fully proven, let us inquire if it has any advantages over the ligature.

1. Secondary hemorrhage is not so liable to occur with Acupressure as with the ligature. There are certain constitutional states, such as the scrofulous diathesis, and other morbid conditions, marked by an aplastic state of the blood, which predispose to secondary hemorrhage. But this accident takes place far more frequently as the result of local causes, (1) from too rapid ulceration, or (2) too extensive sloughing of the vessel at the time of the ligature's separation. On the other hand, where acupressure has been employed, the internal surfaces of the artery have merely been placed in contact, no ulceration or sloughing ensues. Again, it is often possible to compress several vessels with a single needle, as in Case 4, hence, secondary hemorrhage would be less likely to occur than if a ligature had been applied to each vessel separately.

2. Acupressure, as was predicted by Sir J. Y. Simpson, has proven to be the most expeditious way of restraining hemorrhage; and, with a little experience in its practice, the easiest which has yet been devised, and the surgeon requires no assistant as in using the ligature.

3. Acupressure may sometimes be employed where it would be difficult or impossible to seize the vessels with the forceps, and draw them out of their sheaths so as to allow of the application of a ligature. This is demonstrated by the record of the case of clitoridectomy. (p. 20.)

4. Not only can two or more arteries be closed by a single needle, but the venous hemorrhage may be controlled at the same time with the arterial; thus preventing, it may be, the absorption by the open mouths of the veins of noxious fluids from the surface of the wound.

5. The needle can be removed in a few hours, or in two or three days, leaving the interior of the wound free from all foreign bodies; while the ligature is separated by a slow process of ulceration

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\* See Pennsylvania Hospital Reports, 1867.



and sloughing, with the accompanying suppuration; and hence the primary union of wounds must be greatly diminished when acupressure is employed.

6. Acupressure can be practiced with safety upon arteries which are so much diseased, that they are too brittle and friable to bear the strain of a ligature. This was illustrated by a case reported by Dr. Hewson,\* where the ossified brachial was closed satisfactorily after amputation of the arm. Dr. Hewson thinks that if the ligature had been used, it would have cut through the artery, with the probability of secondary hemorrhage. Two cases are reported by Foucher,† where the vessels were ossified and broke under the pressure of the ligature, one of them breaking twice under two successive trials; they were successfully closed by acupressure. In cases of aneurism, where the artery is diseased for some distance above the sack, the vessel may be closed by an acupressure-needle at a point where it would be inexpedient to apply a ligature. Thus, an aneurism of the femoral situated at the inferior angle of Scarpa's space may be treated by acupressure at the upper portion of the femoral, whereas, if treated by deligation, the ligature would have to be placed upon the external iliac artery, a much more serious operation.

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\* See Pennsylvania Hospital Reports, p. 141-146.

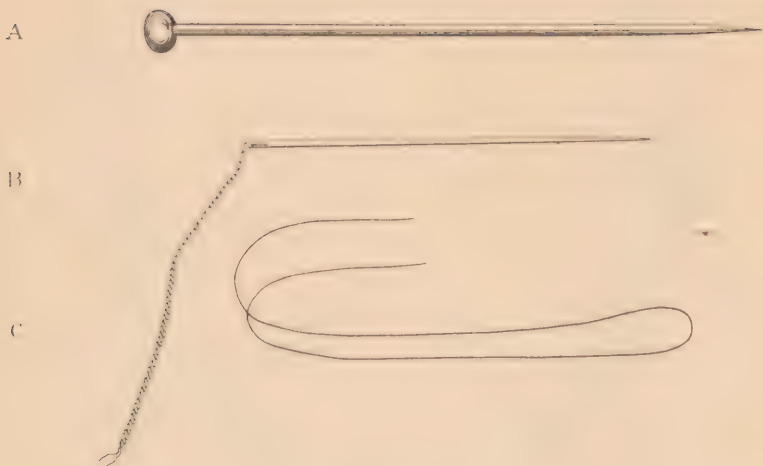
† See Simpson on Acupressure, p. 304-306.







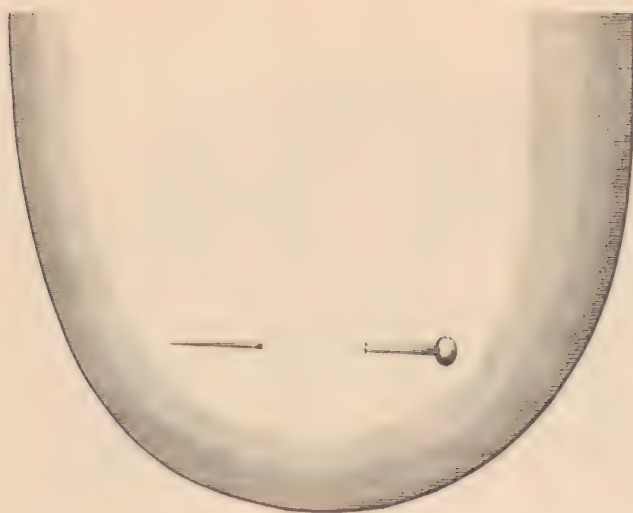
Fig. 1.



- A . Accupressure pin —  
B . Needle armed with iron wire .  
C . Loop of annealed iron wire .



Fig. 2.

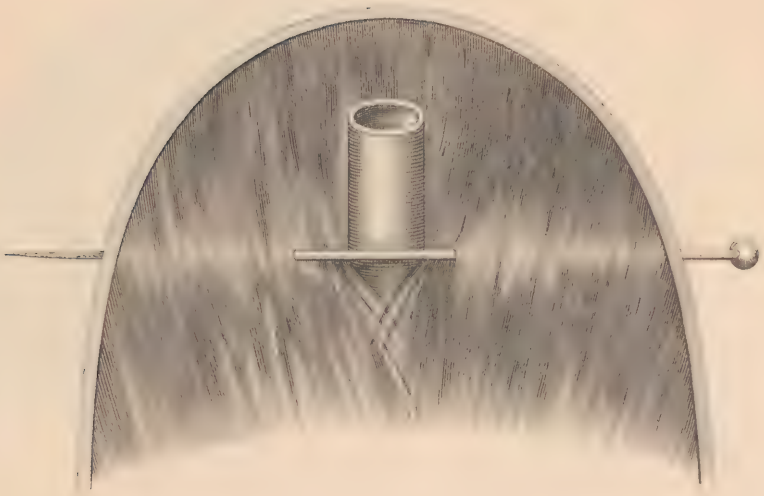


First Method showing the pin on the cutaneous surface of the flap.





Fig. 3



Inner surface of the same flap (Fig. 2.) The artery compressed by the pin .





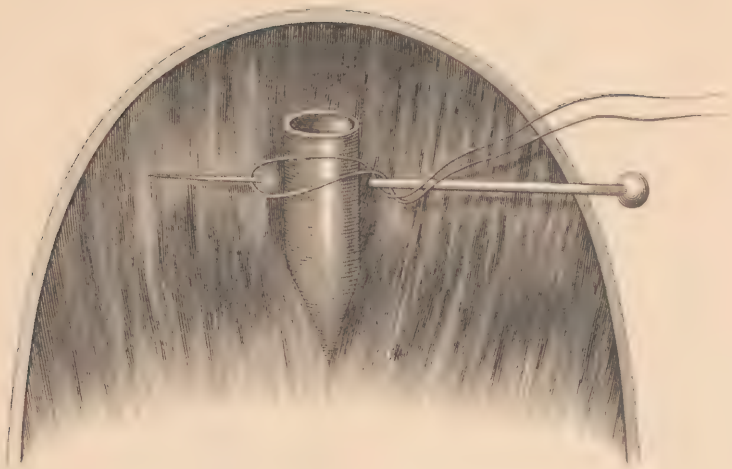
Fig 4.



Second Method by a needle threaded with iron wire to facilitate removal.



Fig.5.



Fourth Method. A pin and a loop of iron wire . The Third Method is the same substituting a needle threaded with iron wire as in Fig.4. for the pin .





Fig. 6



Diagram showing mechanism of the Third and Fourth Methods



Fig.7

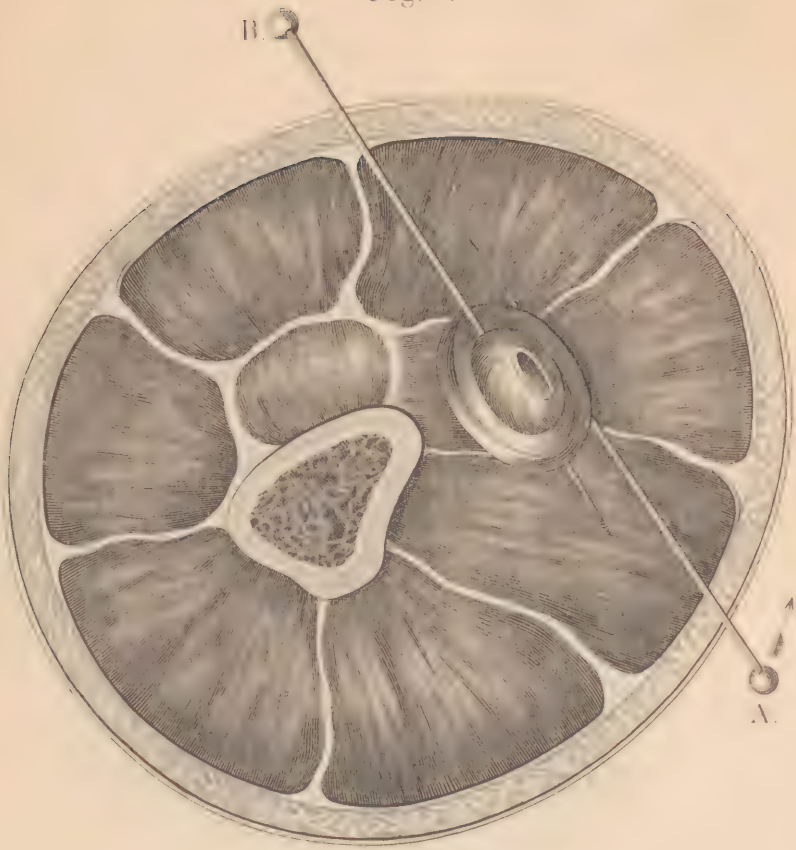


The Fifth Method with a quarter rotation of the pin. A shows the first step transfixion. B. the second step quarter rotation of the pin across the artery and its ultimate insertion into the tissues beyond.





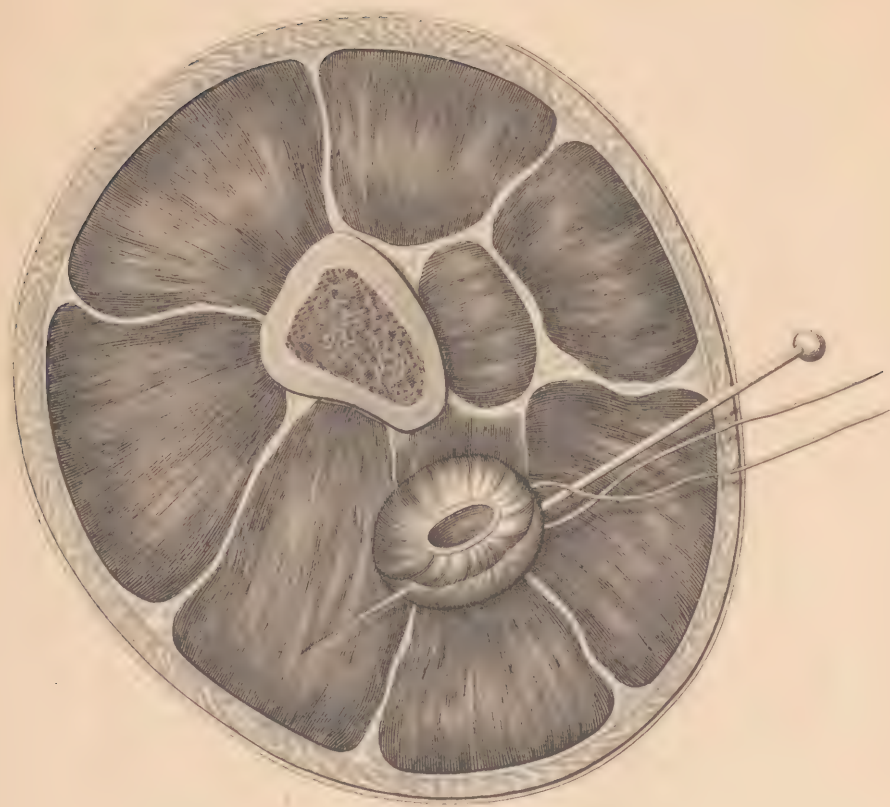
Fig. 8.



The same Method (Fifth) with a half rotation of the pin. A shows the first step transfixion. B. second step half rotation of the pin and the ultimate insertion of the point into the tissues beyond.



Fig.9.



Sixth Method, by a pin and loop of iron wire.





Fig. 10.



Mechanism of Sixth Method showing the arrangement of the wire  
After Time



Fig II.

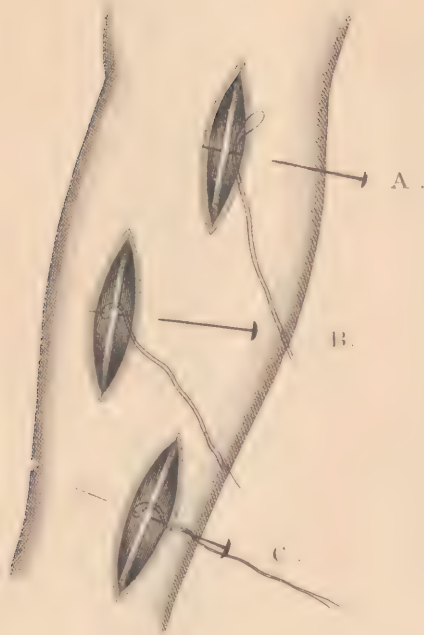


Seventh Method showing pin on the cutaneous surface of the flap. The artery compressed between the middle portion of the needle and the bone.





Fig. 12.



#### Eighth or Brooklyn Method .

Showing a plan for the closing of arteries in their continuity for the treatment of aneurism &c. A. Artery laid bare and a loop of wire beside it, with the pin entering a sufficient distance from the edge of the wound to bring it down to the plan of the vessel. B. the noose thrown over the point of the pin. C. the pin carried through the flap opposite the point of entrance and the artery compressed between the pin and wire .



Fig 14.



Fig 13.



Fig 17.



COMMON CAROTID  
OF SHEEP.

COMMON CAROTID  
OF SHEEP.  
*25 days after Acupressure.*

COMMON CAROTID  
OF DOG.  
*7 days after Acupressure  
in its carotid.*



Fig. 16.

Fig. 18



COMMON CAROTID  
OF SHEEP.  
*47 hours after Acupressure.  
in its Continuity.*



COMMON CAROTID  
OF SHEEP.  
*4 days after Acupressure.*



COMMON CAROTID  
OF SHEEP.  
*10 days after Acupressure.  
in its Continuity.*



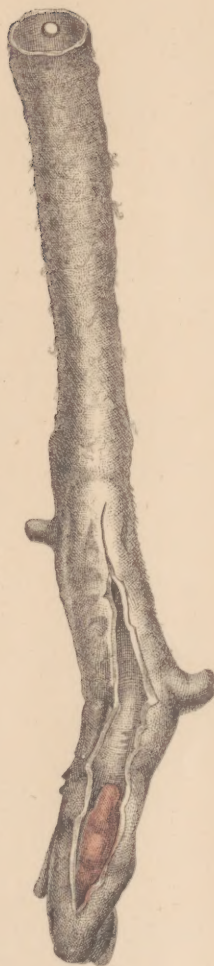


Fig. 19.



COMMON CAROTID,  
OF DOG.  
*24 Days after Acupressure  
in its Continuity.*

Fig. 21.



POSTERIOR TIBIAL,  
HUMAN.  
*49 1/2 Hours after Acupressure.*

Fig. 20.



POPLITEAL ARTERY,  
HUMAN.  
*1 Days after Acupressure*







